



Original communication

Forensic problems with the composition and content of herbal medicines



Lauren Blacksell Student, Roger W. Byard, MD Prof., Forensic Pathologist *,
Ian F. Musgrave, PhD Pharmacologist

School of Health Sciences, The University of Adelaide, Frome Road, Adelaide, SA 5005, Australia

ARTICLE INFO

Article history:

Received 12 November 2013

Received in revised form

30 December 2013

Accepted 19 January 2014

Available online 25 January 2014

Keywords:

Herbal remedies

Regulation

Composition

Adulteration

Death

Autopsy

ABSTRACT

A survey of herbal medicines available for internet and over-the-counter purchase in South Australia, Australia, was conducted looking specifically at those used for 'arthritis', 'cold and flu', 'gastrointestinal', 'stress' and 'premenstrual syndrome'. 121 products consisted of 29 in the 'arthritis' category, 33 in 'cold and flu', 19 in 'gastrointestinal' 30 in 'stress' and 10 in 'premenstrual syndrome'. Twenty two (18%) of 121 products were not registered with the Australian Register of Therapeutic Goods (ARTG), despite this being a legal requirement for their sale. Of the registered products 59 (60%) of 99 had differing ingredient concentrations on the website compared to their ARTG listing. Only three of the 15 purchased products had ingredient concentrations which were consistent between the website, ARTG listing and product packaging. These findings demonstrate that it may not be possible to determine what herbal substance an individual has been exposed to prior to death and in what concentration, based on packaging from medications seized at the scene, or from examination of website data and the ARTG listing. These discrepancies may increase the problems that exist in attempting to determine what role herbal medicines may play in the mechanism of death in certain forensic cases.

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1. Introduction

Recent publications have drawn attention to potential problems that may arise in evaluating the mechanisms of death in forensic post-mortems when decedents have been using herbal remedies.^{1–3}

Problems range from adulteration or contamination with drugs or toxins, to interference with the actions of prescription medications.^{2,4–6} So significant is the latter issue that the American Society of Anesthesiologists recommends ceasing herbal medicines for at least two weeks before surgery to avoid the possibility of herb–drug interactions.⁷

Another issue for forensic pathologists that we have identified is the failure of death scene examiners to fully document the types of herbal preparations that are present at a scene.³ This may be due to the mistaken belief that such remedies are 'natural' and therefore do not pose a problem to health. However, even when herbal medicines are recorded, the question that we would ask is "how accurate are the listed concentrations of ingredients?"

Herbal medicines in Australia are regulated by the Therapeutic Goods Administration (TGA) which means that they must receive an AUST L number and appear in the Australian Register of Therapeutic Goods (ARTG) if they are to be sold.⁸ To evaluate whether there was consistency in the documentation of ingredients in herbal medicines comparison was undertaken between ingredients listed in the ARTG and those listed for the identical products on websites or on product packaging.

2. Materials and methods

The categories (conditions) 'arthritis', 'cold and flu', 'gastrointestinal', 'stress' and 'premenstrual syndrome' were searched for on Australian websites via the search engine Google, using the key words 'herbal medicine', 'purchase' and the specific category. The categories were chosen from a previous study into complementary and alternative medicine use in South Australia.⁹ Only the first page of each result was evaluated and websites selling products from multiple retailers were excluded. Websites which were selling multiple products on the one page had only the first 10 products from that page included. Products were only selected if it was stated that their primary use was for the relief of the condition searched for. Common names of ingredients were matched to their respective botanical names for comparisons where necessary.

* Corresponding author. Discipline of Anatomy & Pathology, Level 3 Medical School North Building, The University of Adelaide, Frome Road, Adelaide 5005, Australia. Tel.: +61 8 8313 5441; fax: +61 8 8313 4408.

E-mail address: roger.byard@sa.gov.au (R.W. Byard).

Table 1
TGA registration status of herbal medicines.

Registered	Arthritis		Cold & flu		GI		Stress		PMS		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Yes	27	93	28	85	12	63	23	77	9	90	99	82
No	2	7	5	15	7	37	7	23	1	10	22	18
Total	29	100	33	100	19	100	30	100	10	100	121	100

GI – gastrointestinal; PMS – premenstrual tension.

Homeopathic products which were exempt from ARTG listing were excluded.

Once identified, the registration status of the products was searched for in the ARTG database.¹⁰ Registered products with listed ingredients on the website of origin were then compared to the TGA approved ingredient concentrations.

An additional study was undertaken where a selection of products for each of the conditions was purchased from pharmacies and health food stores in and around Adelaide, South Australia. A list of pharmacies was prepared using the yellow pages telephone listing website.¹¹ The search terms entered were 'Adelaide' or a specific suburb name and 'Pharmacy'. The filters were set to 'Pharmacies' and were sorted by 'Distance'. The top ten results (excluding duplicates) were used and numbered 1 to 10 in order of appearance in the yellow pages. Three random numbers were generated (between 1 and 10) from the Random Number Generator website.¹² The pharmacies corresponding to these numbers were chosen for product purchase. A list of health food stores was prepared in a similar manner, using the search terms 'Health Food Store' and 'Adelaide' or the suburb name. In cases where a store was either unable to be located or was not selling herbal medicines a pharmacy or health food store within the same shopping complex was substituted.

3. Results

A total of 121 products were included in the study consisting of 29 in the 'arthritis' category, 33 in 'cold and flu', 19 in 'gastrointestinal' 30 in 'stress' and 10 in 'premenstrual syndrome'. Twenty two (18%) of 121 products were not registered with the ARTG. Of the registered products 59 (60%) of 99 had substantially different ingredient concentrations on the website compared to their ARTG listing, with often a 5–10 fold difference. In some cases species (eg. *Rhamnus catharticus* for *Rhamnus frangula*) and product substitution were noted. Only three of the 15 purchased products had ingredient concentrations which were consistent between the website, ARTG listing and packaging.

The products being sold with ingredient concentrations which differed to their ARTG listing varied from large, well-known companies to smaller companies. Three products did not have the ingredients listed on their website. Eight products had concentrations listed in units which were not convertible to the

concentrations in their ARTG listing, such as listing the dry weight of raw plant material on the website and weight of pure compound in the ARTG listing, without a conversion factor (eg. conversion statements such as the following "Silybum marianum fruit 350 mg flavanolignins calculated as Silybin 4.20 mg" were not included). Therefore a comparison of concentrations for these products was unable to be carried out.

Unregistered products were found on the shelves of both pharmacies and health food stores. Eight of the purchased products were registered but displayed at least one ingredient concentration which differed from the specified ARTG registered concentration. Only two products were appropriately labelled, with the ingredients on the packaging matching the ARTG listing.

The registration status of the products with the TGA is summarized in Table 1. Comparisons between the website ingredients and listed concentrations on the ARTG database are summarized in Table 2. The packaging to website and ARTG comparisons are shown in Table 3

4. Discussion

Traditional medicines are used by an estimated 80% of the world's population. In 2004, 69% of Australians used at least some form of complementary and alternative medicine, which is a broad category that includes herbal medicines, the latter used by approximately 23% of Australians.¹³ Between 1993 and 2004 the number of Australians using herbal medicines doubled.⁹ Herbal medicines are readily available at a variety of outlets in Australia including supermarkets, pharmacies and health food stores, as well as through online sites. Due to the large number of herbal medicine users in Australia and the ease of access to products, it is likely that a significant percentage of individuals who undergo medicolegal autopsies have ingested these substances in the days prior to death.

To be sold in Australia, any substance that makes a therapeutic claim must be placed on the Australian Register of Therapeutic Goods (ARTG). Items on the ARTG are placed in one of two categories, Registered and Listed. Registered substances may make specific therapeutic claims, and must present substantial data from preclinical and clinical trials to gain registration. Listed medicines may make only general claims such as "may assist with the [nominated condition]". Listed medicines must hold evidence in support of these claims, as well as evidence of safety. The portfolio for Listed substances is not as rigorous as that for Registered substances, and may simply be evidence that the substance has been used traditionally for a specific purpose. The TGA also requires that the materials used to make the Listed substance are produced under conditions of Good Manufacturing Practice. The licence number of a given substance is for the list of ingredients that are stated to be in the preparation at the time of listing in the ARTG. Any change to the ingredients, either in the amount or the identity, requires a new ARTG listing and number. The majority of herbal and traditional medicines (such as Traditional Chinese Medicine) are Listed, a minority are Registered.

Table 2
Comparison of the ingredient concentrations on websites compared to TGA listings.

Ingredients match	Arthritis		Cold & flu		GI		Stress		PMS		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Yes	10	37	7	25	5	42	8	35	0	0	30	30
No	12	44	18	64	7	58	13	56	9	100	59	60
N/A	5	19	3	11	0	0	2	9	0	0	10	10
Total	27	100	28	100	12	100	23	100	9	100	99	100

GI – gastrointestinal; PMS – premenstrual tension; N/A – unable to determine.

Table 3

Comparisons of ingredient concentrations between the ARTG database and packaging.

Ingredients match	Arthritis		Cold & flu		GI		Stress		PMS		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Yes	0	0	1	75	0	0	2	33.3	0	0	3	20
No	2	67	3	25	0	0	2	33.3	1	100	8	53
N/A	1	33	0	0	1	100	2	33.3	0	0	4	27
Total	3	100	4	100	1	100	6	100	1	100	15	100

GI – gastrointestinal; PMS – premenstrual tension; N/A – unable to determine.

Issues of concern that have been identified with herbal remedies include adulteration with prescription drugs such as steroids,¹⁴ and their potential for interference with the actions of prescribed medications such as warfarin.¹⁵ Herbal remedies may also cause or exacerbate hypertension, hepatic veno-occlusive disease, hepatitis, myocardial infarction and encephalitis.¹⁶ They may also be directly toxic if they are administered by alternative routes.¹⁷

As noted, for a herbal medicine to be legally sold in Australia the product must be registered with the Therapeutic Goods Administration (TGA) and carry an AUST L or R number.⁸ Thus it was of concern that 22 (18%) of the 121 herbal medicines evaluated online were unable to be located in the ARTG database. Most of these products were from smaller, lesser-known companies and often a company would have multiple unregistered products. Of the herbal medicines that were registered 59 (60%) of 99 had ingredient concentrations listed on the website that differed substantially from the concentrations in their respective ARTG listings. In some cases websites listed ingredients but not concentrations, or did not list any ingredients at all. The situation in Australia with regard to the quality of information on websites selling herbal medicines is similar to that seen overseas, where there is also a lack of high quality information.^{18–20}

This study has shown that herbal remedies that are not officially licensed as Listed or Registered are still available for purchase in Australia. Furthermore, amongst the products that have been licensed by the TGA there is considerable disparity between the various listings of ingredients (ARTG, websites, or packaging). The composition of a licensed product cannot be changed and a new license must be sought if changes are made to the concentration of the approved ingredients, or if there is ingredient substitution, addition or deletion. If the latter occur without a new license such products are non-compliant.

These findings re-enforce a 2011 Audit report that demonstrated a high level of non-compliance in Listed products reviewed in 2006 and 2010.²¹ The findings for the 121 herbal medicines in this study are also similar to the results of a review of 110 complementary medicines conducted by the TGA in 2009–2010 for all compliance issues.²¹ The high level of non-compliance found in the current study on labelling alone is disturbing in the light of the recommendations of the 2011 auditors report. As the safety of herbal medicines is assessed by the TGA based on the concentrations in the license, these disparities are concerning, as purchasers may be exposed to potentially hazardous concentrations of materials, or be at higher risk of overdose.

These findings also demonstrate that it may not be possible to determine what herbal substance an individual has been exposed to prior to death and in what concentration. As toxicological testing for herbal compounds is often extremely difficult,¹ especially without some type of guidance, this means that postmortem herbal toxicology is even more problematic. It is likely that these issues could further exacerbate the problems that exist in attempting to determine what role herbal medicines may play in the mechanism of death in certain forensic cases.

Ethical approval

Not required.

Funding

None.

Conflicts of interest

None.

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